7/18/88

MONSANTO

Estimated Cancer Risks from Pumping Data
(units = ppb or ug/l)

Chemical	MCLG	MCL	Concentration	Well #	Date Sampled	Cancer Rating*	Cancer Risk
Vinyl Chloride	0	2	71,499	P3	1/87	A	4.7
Trichloroethene	0	5	343,000	P3	3/86	B2	10^{-1}
Dichloromethane (Methylene chloride)	0	-	630	P8	12/86	B2	10^{-4}
1,2-Dichloroethane		-	600,000	P3	4/86	D	NA
cis-	70	-					
trans-	70	-					

Risk Calculations

Risk = Water Conc (ppb) x Potency Factor x 2 L/d /(70 kg x 1000 ug/mg)

$Risk_{VC} = 71,499 \times 2.3 / 35,000 = 4.7$

$Risk_{TCE} = 343,000 \times 0.011 / 35,000 = 0.1 = 10^{-1}$

$Risk_{MEK} = 630 \times 0.0075 / 35,000 = 0.0001 = 10^{-4}$

Summary Explaination of risk

Vinyl Chloride (VC) - It is estimated every 70 kg adult drinking 2 liters of water per day which was contaminated with vinyl chloride, a known human carcinogen, at the level of 71,499 ppb for a lifetime of 70 years could develop cancer.

Trichloroethylene (TCE) - Using the same assumptions as for vinyl chloride, if the drinking water was contaminated with 343,000 ppb of TCE, a probable human carcinogen, it is estimated one in ten exposed persons could develop cancer.

Methylene chloride (MEK) - Using the same assumptions as for vinyl chloride, if the drinking water was contaminated with 630 ppb of Methylene chloride, a probable human carcinogen, it is estimated one person of ten thousand exposed persons could develop cancer.

*EPA Carcinogen Classification

A - Known Human Carcinogen
B2 - Probable Human Carcinogen (Sufficient Animal Data)
C - Possible Human Carcinogen (Limited Animal Data)
D - Not classified (Insufficient Data)
E - Non-carcinogen (Sufficient Animal Data)

March 31, 1987

VINYL CHLORIDE

Health Advisory Draft
Office of Drinking Water
U.S. Environmental Protection Agency

I. INTRODUCTION

The Health Advisory (HA) Program, sponsored by the Office of Drinking Water (ODW), provides information on the health effects, analytical methodology and treatment technology that would be useful in dealing with the contamination of drinking water. Health Advisories describe nonregulatory concentrations of drinking water contaminants at which adverse health effects would not be anticipated to occur over specific exposure durations. Health Advisories contain a margin of safety to protect sensitive members of the population.

Health Advisories serve as informal technical guidance to assist Federal, State and local officials responsible for protecting public health when emergency spills or contamination situations occur. They are not to be construed as legally enforceable Federal standards. The HAs are subject to change as new information becomes available.

Health Advisories are developed for One-day, Ten-day, Longer-term (approximately 7 years, or 10% of an individual's lifetime) and Lifetime exposures based on data describing noncarcinogenic end points of toxicity. Health Advisories do not quantitatively incorporate any potential carcinogenic risk from such exposure. For those substances that are known or probable human carcinogens, according to the Agency classification scheme (Group A or B), Lifetime HAs are not recommended. The chemical concentration values for Group A or B carcinogens are correlated with carcinogenic risk estimates by employing a cancer potency (unit risk) value together with assumptions for lifetime exposure and the consumption of drinking water. The cancer unit risk is usually derived from the linear multistage model with 95% upper confidence limits. This provides a low-dose estimate of cancer risk to humans that is considered unlikely to pose a carcinogenic risk in excess of the stated values. Excess cancer risk estimates may also be calculated using the One-hit, Weibull, Logit or Probit models. There is no current understanding of the biological mechanisms involved in cancer to suggest that any one of these models is able to predict risk more accurately than another. Because each model is based on differing assumptions, the estimates that are derived can differ by several orders of magnitude.

Occurrence

- Vinyl chloride is a synthetic chemical with no natural sources.

- Since 1979, yearly production of vinyl chloride has been approximately 7 billion lbs (U.S. ITC, 1983). Vinyl chloride is polymerized, and little is released to the environment. Environmental releases will be limited to the areas where vinyl chloride is produced and used.

- Vinyl chloride released to the air is degraded in a matter of a few hours (U.S.EPA, 1980a). Vinyl chloride released to surface waters migrates to the atmosphere in a few hours or days where it undergoes photochemical oxidation. Vinyl chloride which is released to the ground does not adsorb onto soil and migrates readily to ground water. Evidence from laboratory studies suggests that vinyl chloride in ground water may degrade to CO_2 and Cl^- (Vogel and McCarty, 1985). Vinyl chloride is expected to remain in ground water for months to years. Vinyl chloride has been reported to be a degradation product of trichloroethylene and tetrachloroethylene in ground water (Parsons, 1984). Vinyl chloride does not bioaccumulate in individual animals or food chains.

- Vinyl chloride does not occur widely in the environment because of its rapid degradation and limited release. Vinyl chloride is a relatively rare contaminant in ground and surface waters with higher levels found in ground water. The Ground Water Supply Survey of drinking water supplies have found that less than 2% of all ground water derived public water systems contain vinyl chloride at levels of 1 ug/L or higher. Vinyl chloride almost always co-occurs with trichloroethylene. Public systems derived from surface water also have been found to contain vinyl chloride but at lower levels. No information on the levels of vinyl chloride in food have been identified. Based upon the limited uses of vinyl chloride and its physical chemical properties, little or no exposure is expected from food. Vinyl chloride occurs in air in urban areas and near the sites of its production and use. Atmospheric concentrations are in the ppt range (U.S. EPA, 1979).

- The major source of exposure to vinyl chloride is from contaminated water.

III. PHARMACOKINETICS

Absorption

- Vinyl chloride is absorbed rapidly in rats following ingestion and inhalation (Withey, 1976; Duprat et al., 1977).

- Using statistical modeling, Withey and Collins (1976) concluded that, for rats, a total liquid intake containing 20 ppm (wt/wt) vinyl chloride would be equivalent to an inhalation exposure of about 2 ppm (vol/vol) for 24 hours.

system disturbances, pulmonary insufficiency, cardiovascular toxicity, and gastrointestinal toxicity (Miller et al., 1975; Selikoff and Hammond, 1975; Suciu et al., 1975). Data on dose-responses in humans are scarce because few measurements of ambient vinyl chloride levels in the workplace were made before 1975 (Mancuso, 1975).

Animals

Short-term Exposure

- Inhalation exposure to high levels (ca. 100,000 ppm or 260,417 mg/m^3) of vinyl chloride can induce narcosis and death, and, to lower doses, ataxia, narcosis, congestion and edema in lungs and hyperemia in liver in several species (U.S. EPA, 1985a).

Long-term Exposure

- Administration of vinyl chloride monomer to rats by gavage for 13 weeks resulted in hematologic, biochemical and organ weight effects at doses above 30 mg/kg (Feron et al., 1975).

- Inhalation exposure of rats, guinea pigs, rabbits and dogs to 50 ppm (130 mg/m^3) vinyl chloride, 7 hours/day, 130 exposures in 189 days, did not induce toxicity as judged by appearance, mortality, growth, hematology, liver weight and pathology. Rats exposed to 100 ppm (260 mg/m^3) 2 hours/day for six months, had increased liver weights (Torkelson et al., 1961).

Reproductive Effects

- Potential effects on reproductive capacity have not been studied.

Developmental Effects

- Infante et al. (1976a,b) reported an association between human exposure to vinyl chloride and birth defects and fetal loss, but this association was contradicted by Edmonds et al. (1975) and Hatch et al. (1981).

- Inhalation exposure of rats and rabbits to vinyl chloride concentrations as high as 2,500 ppm (6,500 mg/m^3) on days 6 to 15 (rats) and 6 to 18 (rabbits) of gestation and mice to vinyl chloride levels as high as 500 ppm (1,300 mg/m^3) on days 6 to 15 of gestation did not induce teratogenic effects but did increase skeletal variants in high dose mice (John et al., 1977).

- A developmental effects study with vinyl chloride in rats exposed by inhalation to 600 or 6,000 ppm (2,160 or 21,160 mg/m^3) 4 hours daily on gestation days 9 through 21 was negative for teratogenicity and inconclusive for fetotoxicity (Radike et al., 1977).

$$HA = \frac{(NOAEL \text{ or } LOAEL) \times (BW)}{(UF) \times (\_\_\_ \text{ L/day})} = \_\_\_ \text{ mg/L } (\_\_\_ \text{ ug/L})$$

where:

NOAEL or LOAEL = No- or Lowest-Observed-Adverse-Effect-Level in mg/kg bw/day.

BW = assumed body weight of a child (10 kg) or an adult (70 kg).

UF = uncertainty factor (10, 100 or 1,000), in accordance with NAS/ODW guidelines.

___ L/day = assumed daily water consumption of a child (1 L/day) or an adult (2 L/day).

One-day Health Advisory

There are insufficient data for calculation of a One-day Health Advisory. The Ten-day HA of 2.6 mg/L is proposed as a conservative estimate for a One-day HA.

Ten-day Health Advisory

Inhalation data by Torkelson et al. (1961) were not selected for the Ten-day HA calculation because of preference for studies with oral exposure. Feron et al. (1975) reported a subchronic toxicity study in which vinyl chloride monomer (VCM) dissolved in soybean oil was administered by gavage to male and female Wistar rats, initially weighing 44 g, at doses of 30, 100 or 300 mg/kg once daily, 6 days per week for 13 weeks. Several hematological, biochemical and organ weight values were significantly ($P<0.05$ or less) different in both mid- and high-dose animals compared to controls. The NOAEL in this study was identified as 30 mg/kg.

The Ten-day HA, as well as the One-day HA, for a 10-kg child is calculated as follows:

$$\text{Ten-day HA} = \frac{(30 \text{ mg/kg/day}) (6/7) (10 \text{ kg})}{(100) (1 \text{ L/day})} = 2.6 \text{ mg/L } (2{,}600 \text{ ug/L})$$

where:

30 mg/kg/day = NOAEL based on absence of biochemical and organ weight effects in rats exposed orally to vinyl chloride.

6/7 = expansion of 6 days/week treatment in the Feron et al. (1975) study to 7 days/week to represent daily exposure.

10 kg = assumed body weight of a child.

100 = uncertainty factor, chosen in accordance with NAS/ODW guidelines for use with a NOAEL from an animal study.

1 L/day = assumed daily water consumption of a child.

Lifetime Health Advisory

The Lifetime HA represents that portion of an individual's total exposure that is attributed to drinking water and is considered protective of noncarcinogenic adverse health effects over a lifetime exposure. The Lifetime HA is derived in a three step process. Step 1 determines the Reference Dose (RfD), formerly called the Acceptable Daily Intake (ADI). The RfD is an estimate of a daily exposure to the human population that is likely to be without appreciable risk of deleterious effects over a lifetime, and is derived from the NOAEL (or LOAEL), identified from a chronic (or subchronic) study, divided by an uncertainty factor(s). From the RfD, a Drinking Water Equivalent Level (DWEL) can be determined (Step 2). A DWEL is a medium-specific (i.e., drinking water) lifetime exposure level, assuming 100% exposure from that medium, at which adverse, noncarcinogenic health effects would not be expected to occur. The DWEL is derived from the multiplication of the RfD by the assumed body weight of an adult and divided by the assumed daily water consumption of an adult. The Lifetime HA is determined in Step 3 by factoring in other sources of exposure, the relative source contribution (RSC). The RSC from drinking water is based on actual exposure data or, if data are not available, a value of 20% is assumed for synthetic organic chemicals and a value of 10% is assumed for inorganic chemicals. If the contaminant is classified as a Group A or B carcinogen, according to the Agency's classification scheme of carcinogenic potential (U.S. EPA, 1986), then caution should be exercised in assessing the risks associated with lifetime exposure to this chemical.

Because vinyl chloride is classified as a human carcinogen (IARC Group 1 and EPA Group A), a Lifetime Health Advisory is not recommended.

Evaluation of Carcinogenic Potential

- Applying the criteria described in EPA's guidelines for assessment of carcinogenic risk (U.S. EPA, 1986), vinyl chloride may be classified in Group A: Human carcinogen. This category is for agents for which there is sufficient evidence to support the causal association between exposure to the agents and cancer.

- The IARC (1979) has concluded that there is sufficient evidence to classify vinyl chloride as a human carcinogen in its Category 1.

- EPA's Carcinogen Assessment Group (CAG) recently has recalculated its excess carcinogenic risk estimates resulting from lifetime exposure to vinyl chloride through the drinking water (U.S. EPA, 1985a). CAG based its preliminary revised estimates on the Feron et al. (1981) study. The total number of tumors, considering tumors of the lung and liver, in rats exposed through the diet was used to calculate the excess cancer risk. Using the 95% upper limit [$q_1^* = 2.3\ (mg/kg/day)^{-1}$] with the linearized multistage model, they calculated that consuming 2 liters of water per day with vinyl chloride concentration of 1.5 ug/L, 0.15 ug/L and 0.015 ug/L would increase the risk of one excess cancer per 10,000 (10^{-4}), 100,000 (10^{-5}) or 1,000,000 (10^{-6}) people exposed, respectively, per lifetime. The CAG is presently reassessing the cancer risk estimate based on the Feron et al. (1981) study by taking into account the more recent data by Til et al. (1983) which, as

heated to drive off the vinyl chloride onto a gas chromatographic column. This method is applicable to the measurement of vinyl chloride over a concentration range of 0.06 to 1500 ug/L. Confirmatory analysis for vinyl chloride is by mass spectrometry (U.S. EPA, 1985d). The detection limit for confirmation by mass spectrometry is 0.3 ug/L.

VIII. TREATMENT TECHNOLOGIES

- The value of the Henry's Law Constant for vinyl chloride (6.4 atm-m3/mole) suggests aeration as a potential removal technique for vinyl chloride in water (ESE,1984). Removals of up to 99.27% were achieved at 9°C using a pilot packed tower aerator. In similar studies, vinyl chloride was removed from ground water using a spray aeration system with total VOC concentration was 100 to 200 ug/L (ESE, 1984). Greater than 99.9% VOC removal was obtained using a four-stage aeration system; each stage employed 20 shower heads with a pressure drop of approximately 10 pounds per square inch. In-well aeration has also demonstrated up to 97% removal of vinyl chloride using an air-lift pump. However, practical considerations are likely to limit the application of this (Miltner, 1984).

- The concentration of vinyl chloride in southern Florida ground water declined by 25% to 52% following passage through lime softening basins and filters (Wood and DeMarco, 1980). Since vinyl chloride is a highly volatile compound, it is probably volatilized during treatment (ESE, 1984).

- Adsorption techniques have been less successful than aeration in removing vinyl chloride from water. In a pilot study, water from a ground water treatment plant was passed through a series of four 30-inch granular activated carbon (Filtrasorb 400) columns (Wood and DeMarco, 1980; Symons, 1978); the empty bed contact time was approximately six minutes per column. Influent vinyl chloride concentrations ranged from below detection to 19 ug/l; erratic removal was reported. To maintain effluent concentrations below 0.5 ug/l, the estimated column capacity to breakthrough was 810, 1,250, 2,760 and 2,050 bed volumes for empty bed contact times of 6, 12, 19 and 25 minutes, respectively. In addition, the estimated service life of the activated carbon was low. Similarly, poor removal of vinyl chloride was achieved using an experimental synthetic resin, Ambersorb XE-340, (Symons, 1978).

- Treatment technologies for the removal of vinyl chloride from water have not been extensively evaluated except on an experimental level. Available information suggests aeration merits further investigation. Selection of individual or combinations of technologies to achieve vinyl chloride removal must be based on a case-by-case technical evaluation, and an assessment of the economics involved.

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Trichloroethylene; CASRN 79-01-6 (03/01/88)

Health risk assessment information on a chemical is included in IRIS onl after a comprehensive review of chronic toxicity data by work groups com of U.S. EPA scientists from several Program Offices. The summaries pres in Sections I and II represent a consensus reached in the review process other sections contain U.S. EPA information which is specific to a parti EPA program and has been subject to review procedures prescribed by that Program Office. The regulatory actions in Section IV may not be based o most current risk assessment, or may be based on a current, but unreview risk assessment, and may take into account factors other than health eff (e.g., treatment technology). When considering the use of regulatory ac data for a particular situation, note the date of the regulatory action, date of the most recent risk assessment relating to that action, and whe technological factors were considered. Background information and expla ations of the methods used to derive the values given in IRIS are provid the five Background Documents in Service Code 5, which correspond to Sec

I through V of the chemical files.

STATUS OF DATA FOR Trichloroethylene

File On-Line 03/31/87

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	pending	
Inhalation RfD Assessment (I.B.)	no data	
Carcinogenicity Assessment (II.)	on-line	03/01/88
Drinking Water Health Advisories (III.A.)	no data	
U.S. EPA Regulatory Actions (IV.)	on-line	03/01/88
Supplementary Data (V.)	no data	

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_I. CHRONIC HEALTH HAZARD ASSESSMENT FOR NONCARCINOGENIC EFFECTS

Substance Name -- Trichloroethylene
CASRN -- 79-01-6

A risk assessment for this chemical is under review by an EPA work group

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_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Trichloroethylene
CASRN -- 79-01-6
Last Revised -- 03/01/88

Section II provides information on three aspects of the carcinogenic ris assessment for the agent in question; the U.S. EPA classification, and q itative estimates of risk from oral exposure and from inhalation exposur The classification reflects a weight-of-evidence judgment of the likelih that the agent is a human carcinogen. The quantitative risk estimates a presented in three ways. The slope factor is the result of application low-dose extrapolation procedure and is presented as the risk per mg/kg/ The unit risk is the quantitative estimate in terms of either risk per u drinking water or risk per ug/cu.m air breathed. The third form in whic is presented is a drinking water or air concentration providing cancer r of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to d the carcinogenicity values found in IRIS. Users are referred to Section information on long-term toxic effects other than carcinogenicity.

<<< Trichloroethylene >>>

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Positive responses in two strains of mice by two routes and suggestive increases in tumor incidences in male rats by gavage form the for this classification. Supporting evidence does not downgrade the classification.

___II.A.2. HUMAN CARCINOGENICITY DATA

Three cohort studies of exposed workers (Axelson, 1978; Tola et al., 1980; Malek et al., 1979) found no excess cancer risk associated with tr chloroethylene expos
ure. Results from a case-control study of malignant lymphoma cases by Hardell (1981) were suggestive of an association betwe trichloroethylene exposure and malignant lymphoma, but the study had var limitations. Studies by Novotna et al. (1979) and Paddle (1983) of live cancer cases found no association with trichloroethylene exposure. No c trols were used in the latter two studies.

<<< Trichloroethylene >>>

___II.A.3. ANIMAL CARCINOGENICITY DATA

Positive evidence of carcinogenicity has generally come from studies mice. Negative results have been obtained from gavage treatment of Osborne-Mendel rats, Sprague-Dawley rats and ICR/Ha Swiss mice (NCI, 197 Maltoni, 1979; Henschler et al., 1984). The NCI (1976) study may be inc clusive due to high mortality and the Maltoni (1979) exposure was carrie out for a less-than-lifetime period. An NTP (1983) study found a small increase in incidence of renal adenocarcinomas in male Fischer 344 rats treated by gavage. This was significant by statistical tests that took survival differences into account, but not by the unadjusted Fisher Exac test.

Henschler et al. (1980) found a significant increase in malignant ly phomas in female Han:NMRI mice exposed by inhalation. The spontaneous i dence of lymphomas in controls was also high. Inhalation treatment of t following produced negative results: Charles River rats; Han:Wist rats, Syrian hamsters and male Han:NMRI mice (Bell et al., 1978; Henschler et 1980).

Trichloroethylene did not serve as either an initiator or as a compl skin carcinogen (van Duuren et al., 1979) Trichloroethylene oxide was a negative in an initiation-promotion assay and after s.c. injection.

Male and female B6C3F1 mice were treated 5 days/week for 78 weeks by corn oil gavage with epoxide-stabilized trichloroethylene. Doses were TWA were 1169 and 2339 mg/kg for males and 869 and 1739 mg/kg for female cinomas (NCI, 1976).

A repeat bioassay confirmed the observation of increased incidence o hepatocellular carcinoma. In this study, male and female B6C3F1 mice we treated with purified trichloroethylene containing no detectable epoxide corn oil gavage of 1000 mg/kg/day, 5 days/week for 103 weeks (NTP, 1983)

<<< Trichloroethylene >>>

___II.A.4. SUPPORTING DATA
FOR CARCINOGENICITY

Trichloroethylene of various grades of purity was negative or weakly positive in mutagenicity assays with S. typhimurium, E. coli and S. pomb It was mutagenic for both S. cerevisiae and in the mouse spot test. Whi tests for chromosomal aberrations were negative, trichloroethylene produ mitotic recombination in S. cerevisiae and borderline positive responses Metabolites of trichloroethylene have likewise produced variable, largel negative, responses (U.S. EPA, 1985). Trichloroethylene oxide, however, been shown to transform Syrian hamster embryo cells after in vitro expos (DiPaolo and Doniger, 1982).

------<<< Trichloroethylene >>>------

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 1.1E-2/mg/kg/day

Drinking Water Unit Risk -- 3.2E-7/ug/L

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	3E+2 ug/L
E-5 (1 in 100,000)	3E+1 ug/L
E-6 (1 in 1,000,000)	3E+0 ug/L

<<< Trichloroethylene >>>

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Species/Strain Tumor Type	Dose Administered	Dose Human Equivalent	Tumor Incidence	Slope Factor /mg/kg/day	Refe
Mouse/B6C3F1, male and female; hepatocellular carcinomas	Route: Oral, gavage mg/kg/day	mg/kg/day			
male	0	0	8/48	1.9E-2	NTP,
	1000	47.39	30/50		
female	0	0	2/49	8.0E-3	
	1000	45.62	13/49		
male	0	0	1/20	1.8E-2	NCI,
	1169	45.11	26/50		
	2339	85.80	31/48		
female	0	0	0/20	5.8E-3	
	869	31.65	4/50		
	1739	61.43	11/47		

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Metastases to the lungs were observed in one control male and five treated males in the NTP (1983) study. Survival of treated males was decreased by comparison with controls. Doses for the NCI (1976) study a TWA. There was little toxicity in this study not attributed to tumor development. The slope factor used for the unit risk is the geometric m of the four slope factors above.

Data on metabolism of gavaged trichloroethylene in Swiss Cox mice (B and O'Flaherty, 1985) suggest that the NTP (1983) gavage assay dose of 1 mg/kg/day is within the linear portion of the dose/amount metabolized cu the high doses of the NCI (1976) bioassay approach the saturation of met lism. Human equivalent lifetime average metabolized doses were calculat using the reported weights of 0.04 kg for male mice and 0.035 kg for fem mice (NTP, 1983) and 0.033 kg male, 0.026 kg female (NCI, 1976).

The unit risk should not be used if the water concentration exceeds ug/L, since above this concentration the slope factor may differ from th stated.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Slope factors for male and female B6C3F1 mice from two independent s are very close (all within a factor of 3). Adequate numbers of animals

studied, and tumor incidences were, significantly elevated in a comparab fashion, although the follow-up studies had only only one positive dose

------<<< Trichloroethylene >>>------

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPO

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Slope Factor -- 1.3E-2/mg/kg/day

Inhalation Unit Risk -- 1.3E-6/ug/cu.m

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	8E+1 ug/cu.m
E-5 (1 in 100,000)	8E+0 ug/cu.m
E-6 (1 in 1,000,000)	8E-1 ug/cu.m

<<< Trichloroethylene >>>

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose Administered	Dose Human Equivalent	Tumor Incidence	Refer

The slope factor of 1.3E-2/mg metabolized trichloroethylene/kg/day i geometric mean of the following slope factors prepared by modeling the a data on the basis of a metabolized dose: 2.2E-2 male mice (NTP, 1983); female mice (NTP, 1983); 2.1E-2 male mice (NCI, 1976); 6.9E-3 male mice 1976).

The unit risk was calculated from oral data as follows:

Unit risk = 1.3E-2 x 9.9E-5

where: 1.3E-2 = slope factor (/mg metabolized dose/kg/day)
9.9E-5 = body metabolite load

<<< Trichloroethylene >>>

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

Data by Monster et al. (1976) were used as the basis for estimation the amount of trichloroethylene metabolized by humans exposed to 1 mg/cu The mean amount metabolized was 439 mg for four subjects exposed to 70 p for 4 hours. The amount of metabolite formed following continuous 24-ho exposure to 1 ug/cu.m was estimated to be 9.9E-5 mg/kg/day.

The unit risk should not be used if the air concentration exceeds 8E ug/cu.m, since above this concentration the slope factor may differ from that stated.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSU

There are data from metabolism studies on inhalation of trichloro-ethylene by human subjects to justify dose assumptions used in preparing inhalation estimate.

------<<< Trichloroethylene >>>------

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESS

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health Assessment Document for Trichloroethylene. Pre pared by the Office of Health and Environmental Assessment, Environmenta Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-82-006F.

NTP (National Toxicology Program). 1983. Carcinogenesis Bioassay of Tr chloroethylene (CAS No. 79-01-6). NTP Report No. 81-84. HHS Publ. No. 1799.

NCI (National Cancer Institute). 1976. Carcinogenicity Bioassay of Tri

chloroethylene (CAS No. 79-01-6). Carcinogenesis Technical Report Serie No. 2.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1985 Health Assessment Document for Trichloroethylene received b an Agency and external review.

Agency Work Group Review: 12/04/86

Verification Date: 12/04/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Robert Beliles / ORD -- (202)382-7436 / FTS 382-7436
Chao W. Chen / ORD -- (202)382-5898 / FTS 382-5898

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_III. HEALTH HAZARD ASSESSMENTS FOR VARIED EXPOSURE DURATIONS

Substance Name -- Trichloroethylene
CASRN -- 79-01-6

Not available at this time

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_IV. U.S. EPA REGULATORY ACTIONS

Substance Name -- Trichloroethylene
CASRN -- 79-01-6
Last Revised -- 03/01/88

EPA risk assessments may be updated as new data are published and as assessment methodologies evolve. Regulatory actions are frequently not updated at the same time. Compare the dates for the regulatory actions this section with the verification dates for the risk assessments in sec I and II, as this may explain inconsistencies. Also note that some regu actions consider factors not related to health risk, such as technical o economic feasibility. Such considerations are indicated for each action addition, not all of the regulatory actions listed in this section invol enforceable federal standards. Please direct any questions you may have concerning these regulatory actions to the U.S. EPA contact listed for t particular action. Users are strongly urged to read the background info ation on each regulatory action in Background Document 4 in Service Code

<<< Trichloroethylene >>>

__IV.A. CLEAN AIR ACT (CAA)

___IV.A.1. CAA REGULATORY DECISION

Action -- Intent to list under Section 112

Considers technological or economic feasibility? -- NO

Discussion -- Trichloroethylene (TCE) is a probable human carcingen (EP Group B2) and according to EPA's preliminary risk assessment from ambien exposures, public health risks are significant (4.1 cancer cases/year an maximum lifetime individual risks of 9.4xE-5). Thus, EPA indicated that intends to add TCE to the list of hazardous air pollutants for which it intends to establish emission standards under section 112(b)(1)(A) of th Clean Air Act. The EPA will decide whether to add TCE to the list only studying possible techniques that might be used to control emissions and further assessing the public health risks. The EPA will add TCE to the if emissions standards are warranted.

Reference -- 50 FR 52422 (12/23/85)

EPA Contact -- Emissions Standards Division, OAQPS
(917)541-5571 / FTS 629-5571

------<<< Trichloroethylene >>>------

__IV.B. SAFE DRINKING WATER ACT (SDWA)

___IV.B.1. MAXIMUM CONTAMINANT LEVEL GOAL (MCLG) for Drinking Water

Value (status) -- 0 mg/L (Proposed, 1985)

Considers technological or economic feasibility? -- NO

Discussion -- An MCLG of 0 mg/L for trichloroethylene is proposed based carcinogenic effects. Significant increases in the incidence of liver t have been reported in B6C3F1 mice of both sexes. Malignant lymphomas an pulmonary adenocarcinomas were also reported in mice. EPA has classifie trichloroethylene in Group B2: sufficient evidence in animals and inade evidence in humans.

Reference -- 50 FR 46880 Part III (11/13/85)

EPA Contact -- Criteria and Standards Division, ODW /

(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

<<< Trichloroethylene >>>

___IV.B.2. MAXIMUM CONTAMINANT LEVEL (MCL) for Drinking Water

Value (status) -- 5 ug/L (Final, 1987)

Considers technological or economic feasibility? -- YES

Discussion --

Reference -- 52 FR 35690

EPA Contact -- Criteria and Standards Division, ODW /
(202)382-7571 / FTS 382-7571; or Drinking Water Hotline / (800)426-4791

------<<< Trichloroethylene >>>------

__IV.C. CLEAN WATER ACT (CWA)

___IV.C.1. AMBIENT WATER QUALITY CRITERIA, Human Health

Water and Fish Consumption -- 2.7E+0 ug/L

Fish Consumption Only -- 8.07E+1 ug/L

Considers technological or economic feasibility? -- NO

Discussion -- For the maximum protection from the potential carcinogeni
properties of this chemical, the ambient water concentration should be z
However, zero may not be attainable at this time, so the recommended cri
represents a E-6 estimated incremental increase of cancer risk over a
lifetime.

Reference -- 45 FR 79318 (11/28/80)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

<<< Trichloroethylene >>>

___IV.C.2. AMBIENT WATER QUALITY CRITERIA, Aquatic Organisms

Freshwater:

Acute LEC -- 4.5E+4 ug/L
Chronic LEC -- None

Marine:

Acute LEC -- 2.0E+3 ug/L
Chronic LEC -- None

Considers technological or economic feasibility? -- NO

Discussion -- The values that are indicated as "LEC" are not criteria, are the lowest effect levels found in the literature. LECs are given wh minimum data required to derive water quality criteria are not available

Reference -- 45 FR 79318 (11/28/80)

EPA Contact -- Criteria and Standards Division, OWRS

(202)475-7315 / FTS 475-7315

------<<< Trichloroethylene >>>------

__IV.D. FEDERAL INSECTICIDE AND RODENTICIDE ACT (FIFRA)

No data available

------<<< Trichloroethylene >>>------

__IV.E. TOXIC SUBSTANCES CONTROL ACT (TSCA)

No data available

------<<< Trichloroethylene >>>------

__IV.F. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

___IV.F.1. RCRA APPENDIX IX, for Ground Water Monitoring

Status -- Listed

Reference -- 52 FR 25942 (07/09/87)

EPA Contact -- Jerry Garman / OSW / (202)382-4658 / FTS 382-4658

------<<< Trichloroethylene >>>------

__IV.G. SUPERFUND (CERCLA)

___IV.G.1. REPORTABLE QUANTITY (RQ) for Release into the Environment

Value (status) -- 100 pounds (Proposed, 1987)

Considers technological or economic feasibility? -- NO

Discussion -- The proposed RQ for trichloroethylene is 100 pounds, base potential carcinogenicity. The available data indicate a hazard ranking low, based on a potency factor of 0.070 (mg/kg/day)-1 and weight-of-evid classification B2, which corresponds to an RQ of 100 pounds.

Reference -- 52 FR 8140 (03/16/87)

EPA Contact -- RCRA/Superfund Hotline
(800)424-9346 / (202)382-3000 / FTS 382-3000

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_V. SUPPLEMENTARY DATA

Substance Name -- Trichloroethylene
CASRN -- 79-01-6

Not available at this time

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_VI. REFERENCES

Substance Name -- Trichloroethylene
CASRN -- 79-01-6

Not available at this time

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SYNONYMS: ETHYLENE, TRICHLORO-; ACETYLENE TRICHLORIDE; ALGYLEN; ANAMENT BENZINOL; BLACOSOLV; BLANCOSOLV; CECOLENE; CHLORILEN; 1-CHLORO-2,2-DICHLOROETHYLENE; CHLORYLEA; CHLORYLEN; CHORYLEN; CIRCOSOLV; CRAWHASPOL; DENSINFLUAT; 1,1-DICHLORO-2-CHLOROETHYLENE; DOW-TRI; DUKERON; ETHINYL TRICHLORIDE; ETHYLENE TRICHLORIDE; FLECK-FLIP; FLOCK FLIP; FLUATE; GEMAL GERMALGENE; LANADIN; LETHURIN; NARCOGEN; NARKOGEN; NARKOSOID; NCI-C04546 NIALK; PERM-A-CHLOR; PERM-A-CLOR; PETZINOL; PHILEX; RCRA WASTE NUMBER U2 TCE; THRETHYLEN; THRETHYLENE; TRETHYLENE; TRI; TRIAD; TRIAL; TRIASOL; TRICHLOORETHEEN (Dutch); TRICHLOORETHYLEEN, TRI (Dutch); TRICHLORAETHEN (German); TRICHLORAETHYLEN, TRI (German); TRICHLORAN; TRICHLOREN; TRICHLORETHENE (French); TRICHLORETHYLENE; TRICHLORETHYLENE, TRI (French TRICHLOROETHENE; TRICHLOROETHYLENE; 1,1,2-TRICHLOROETHYLENE; 1,2,2-TRICHLOROETHYLENE; TRICHLOROETHYLENE (ACGIH,DOT); TRI-CLENE; TRICLORETEN (Italian); TRICLOROETILENE (Italian); TRIELENE; TRIELIN; TRIELINA (Itali TRIKLONE; TRILEN; TRILENE; TRILINE; TRIMAR; TRIOL; TRI-PLUS; TRI-PLUS M; 1710 (DOT); VESTROL; VITRAN; WESTROSOL

Dichloromethane; CASRN 75-09-2 (03/01/88)

Health risk assessment information on a chemical is included in IRIS onl after a comprehensive review of chronic toxicity data by work groups com of U.S. EPA scientists from several Program Offices. The summaries pres in Sections I and II represent a consensus reached in the review process other sections contain U.S. EPA information which is specific to a parti EPA program and has been subject to review procedures prescribed by that Program Office. The regulatory actions in Section IV may not be based o most current risk assessment, or may be based on a current, but unreview risk assessment, and may take into account factors other than health eff (e.g., treatment technology). When considering the use of regulatory ac data for a particular situation, note the date of the regulatory action, date of the most recent risk assessment relating to that action, and whe technological factors were considered. Background information and expla ations of the methods used to derive the values given in IRIS are provid the five Background Documents in Service Code 5, which correspond to Sec I through V of the chemical files.

STATUS OF DATA FOR Dichloromethane

File On-Line 01/31/87

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	03/01/88
Inhalation RfD Assessment (I.B.)	no data	
Carcinogenicity Assessment (II.)	on-line	03/01/88
Drinking Water Health Advisories (III.A.)	on-line	03/01/88
U.S. EPA Regulatory Actions (IV.)	on-line	03/01/88
Supplementary Data (V.)	no data	

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_I. CHRONIC HEALTH HAZARD ASSESSMENT FOR NONCARCINOGENIC EFFECTS

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2
Last Revised -- 03/01/88

The Reference Dose (RfD) is based on the assumption that thresholds exis certain toxic effects such as cellular necrosis, but may not exist for o toxic effects such as carcinogenicity. In general, the RfD is an estima (with uncertainty spanning perhaps an order of magnitude) of a daily exp

to the human population (including sensitive subgroups) that is likely t without an appreciable risk of deleterious effects during a lifetime. P refer to Background Document 1 in Service Code 5 for an elaboration of t concepts. RfDs can also be derived for the noncarcinogenic health effec compounds which are also carcinogens. Therefore, it is essential to ref other sources of information concerning the carcinogenicity of this subs If the U.S. EPA has evaluated this substance for potential human carcino icity, a summary of that evaluation will be contained in Section II of t file when a review of that evaluation is completed.

<<< Dichloromethane >>>

__I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfDo)

___I.A.1. ORAL RfD SUMMARY

Critical Effect	Experimental Doses*	UF	MF	Rf
Liver toxicity 2-Year Rat Drinking Water Bioassay	NOAEL: 5.85 and 6.47 mg/kg/day for males and females, respectively	100	1	6E mg/k
National Coffee Association, 1982	LOAEL: 52.58 and 58.32 mg/kg/day for males and females, respectively			

*Dose Conversion Factors & Assumptions: Doses reflect actual values an nominal ones.

<<< Dichloromethane >>>

___I.A.2. PRINCIPAL AND SUPPORTING STUDIES (ORAL RfD)

National Coffee Association. 1982. 24-Month chronic toxicity and oncog study of methylene chloride in rats. Final Report. Prepared by Hazleto Laboratories America, Inc., Vienna, VA. (Unpublished)

The chosen study appears to have been very well conducted, with 85 r sex at each of four nominal dose groups (i.e., 5, 50, 125 and 250 mg/kg/ for 2 years. A high-dose recovery group of 25 rats/sex, as well as two control groups of 85 and 50 rats/sex, was also tested. Many effects wer monitored. Treatment related histological alterations of the liver were evident at nominal doses of 50 mg/kg/day or higher. The low nominal dos mg/kg/day was a NOAEL.

The supporting data base is limited. A NOAEL of 87 mg/cu.m was repo in one inhalation study (Haun et al., 1972). [The equivalent oral dose about 28 mg/kg bw/day (i.e., 87 mg/cu.m x 0.5 x 0.223 cu.m/day/0.35 kg; exposure values are for rats).]

___I.A.3. UNCERTAINTY AND MODIFYING FACTORS (ORAL RfD)

UF = 100. (10a x 10h) The 100-fold factor accounts for both the expect intra- and interspecies variability to the toxicity of this chemical in of specific data.

MF = 1

<<< Dichloromethane >>>

___I.A.4. ADDITIONAL COMMENTS (ORAL RfD)

None.

___I.A.5. CONFIDENCE IN THE ORAL RfD

Study: High
Data Base: Medium
RfD: Medium

The study is given a high confidence rating because a large number o animals of both sexes were tested in four dose groups, with a large numb controls. Many effects were monitored and a dose-related increase in se was observed. The data base is rated medium to low because only a few s support the NOAEL. Medium confidence in the RfD follows.

___I.A.6. EPA DOCUMENTATION AND REVIEW OF THE ORAL RfD

U.S. EPA. 1985. Drinking Water Criteria Document for Methylene Chlorid Office of Drinking Water, Washington, DC.

Agency RfD Work Group Review: 06/24/85, 07/08/85, 11/06/85

Verification Date: 11/06/85

___I.A.7. EPA CONTACTS (ORAL RfD)

Krishan Khanna / ODW -- (202)382-7588 / FTS 382-7588

Michael L. Dourson / ORD -- (513)569-7544 / FTS 684-7544

------<<< Dichloromethane >>>------

__I.B. REFERENCE DOSE FOR CHRONIC INHALATION EXPOSURE (RfDi)

Not available at this time

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_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2
Last Revised -- 03/01/88

Section II provides information on three aspects of the carcinogenic ris assessment for the agent in question; the U.S. EPA classification, and q itative estimates of risk from oral exposure and from inhalation exposur The classification reflects a weight-of-evidence judgment of the likelih that the agent is a human carcinogen. The quantitative risk estimates a presented in three ways. The slope factor is the result of application low-dose extrapolation procedure and is presented as the risk per mg/kg/ The unit risk is the quantitative estimate in terms of either risk per u drinking water or risk per ug/cu.m air breathed. The third form in whic is presented is a drinking water or air concentration providing cancer r of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to d the carcinogenicity values found in IRIS. Users are referred to Section information on long-term toxic effects other than carcinogenicity.

<<< Dichloromethane >>>

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Inadequate data in humans and increased cancer incidence in ra mice

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. Neither of two studies of chemical factory workers show an excess of cancers (Friedlander et al., 1978, 1985; Ott et al., 1983). the former study, exposures were low, but the data provide some suggesti of an increased incidence of pancreatic tumors. The latter report was designed to examine cardiovascular effects, and the study period was too short to allow for latency of site-specific cancers.

<<< Dichloromethane >>>

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. In a 2-year study (National Coffee Association, 1982, 1 F344 rats received 0, 5, 50, 125, or 250 mg dichloromethane/kg/day in dr ing water. B6C3Fl mice consumed 0, 60, 125, 185, or 250 mg/kg/day in wa Female rats responded with increased incidence of neoplastic nodules or hepatocellular carcinomas, which was significant by comparison to matche not to historical controls. Male rats did not show an increased inciden liver tumors. Male mice had elevated incidences of combined neoplastic nodules and hepatocellular carcinomas, but female mice did not. This in was not statistically significant or dose-related. An NTP (1982) gavage of rats and mice has not been published because of data discrepancies.

Inhalation exposure of male and female Syrian hamsters to 0, 500, 15 3500 ppm dichloromethane for 6 hours/day, 5 days/week for 2 years did no produce neoplasia. Female Sprague-Dawley rats exposed under the same co tions experienced reduced survival at the highest dose. Increased incid of mammary tumors were noted in both males and females. Male rats also developed salivary gland sarcomas (Burek et al., 1984). There is a ques as to whether these doses were at or near the MTD. In a subsequent stud (Burek et al., 1984) male and female rats were exposed to 0, 50, 200 or ppm dichloromethane. No salivary tumors were observed, but the highest resulted in mammary tumors.

Groups of 50 each male and female F344/N rats and B6C3Fl mice were e to dichloromethane 6 hours/day, 5 days/week for 2 years. Exposure concentrations were 0, 1000, 2000, or 4000 ppm for rats and 0, 2000, or ppm for mice. Survival of male rats was low, but apparently not treatme related; survival was decreased in a treatment-related fashion for male female mice and female rats. Mammary adenomas and fibroadenomas were increased in male and female rats as were mononuclear cell leukemias in rats. Among treated mice of both sexes there were increased incidences hepatocellular adenomas and carcinomas and highly significant increases alveolar/bronchiolar adenomas and carcinomas (NTP, 1986).

Two inhalation assays using dogs, rabbits, guinea pigs, and rats wer negative, but were not carried out for the lifetime of the animals (Hepp al., 1944; MacEwen et al., 1972). Theiss et al. (1977) injected strain mice intraperitoneally with 0, 160, 400, or 800 mg/kg for 16-17 times. Pulmonary adenomas were found, but survival of animals was poor.

<<< Dichloromethane >>>

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Dichloromethane is mutagenic for Salmonella typhimurium with or with added hepatic enzymes (Green, 1983) and produced mitotic recombination i yeast (Callen et al., 1980). Results in cultured mammalian cells have g erally been negative, but dichloromethane has been shown to transform ra embryo cells and to enhance viral transformatlon of Syrian hamster embry cells (Price et al., 1978; Hatch et al., 1983).

------<<< Dichloromethane >>>------

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 7.5E-3/mg/kg/day

Drinking Water Unit Risk -- 2.1E-7/ug/L

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	5E+2 ug/L
E-5 (1 in 100,000)	5E+1 ug/L
E-6 (1 in 1,000,000)	5E+0 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Species/Strain Tumor Type	Dose Administered	Dose Human Equivalent	Tumor Incidence	Refere
------<<< Dichloromethane >>>------				
Mouse/B6C3F1, female; hepatocellular adenomas or carcinomas	Route: Inhalation			NTP, 1
	ppm	mg/kg/day	mg/kg/day	
	0	0	0	3/50
	2000	1582	122	16/48
	4000	3162	244	40/48
Mouse/B6C3F1, male; hepatocellular carcinomas or adenomas	Route: Water			Nation Coffee Associ 1983
		mg/kg/day	mg/kg/day	
		0	0	24/125
		60	4.5	51/200
		125	9.4	30/100
		185	14.0	31/99
		250	18.9	35/125

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Dichloromethane is rapidly absorbed following either inhalation or ingestion. Use of inhalation data for calculation of risk is justified lung tumor data are excluded. The slope factor is an arithmetic mean of factors derived from NTP (1986) and the National Coffee Association (198

data (2.6E-3 and 1.2E-2, respectively). Dose conversions used the mouse midpoint weight of 0.032 kg and estimated inhalation rate of 1.0407 cu.m To obtain estimates of unit risk for humans, an inhalation rate of 20 cu was assumed. Dichloromethane was considered to be a well-absorbed vapor low doses. As of December, 1987, a revision of the cancer risk assessme pending final approval. This revision is based on the incorporation of information on pharmacokinetics and metabolism.

The unit risk should not be used if the water concentration exceeds ug/L, since above this concentration the slope factor may differ from th stated.

<<< Dichloromethane >>>

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Adequate numbers of animals were treated in both assays used for mod Incidences of tumors in the NTP (1986) bioassay were significantly incre in a dose-related fashion. Incidences in the National Coffee Associatio (1983) study were elevated by comparison to controls ($p<0.05$ for the 125 and 250 mg/kg/day groups). Risk estimates based on the more sensitive s each study were within a factor of 5.

------<<< Dichloromethane >>>------

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPO

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Slope Factor -- 1.4E-2/mg/kg/day

Inhalation Unit Risk -- 4.1E-6/ug/cu.m

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E+1 ug/cu.m
E-5 (1 in 100,000)	2E+0 ug/cu.m
E-6 (1 in 1,000,000)	2E-1 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose Administered	Dose Human Equivalent	Tumor Incidence	Refer

------<<< Dichloromethane >>>------

Mouse/B6C3F1, female; combined carcinomas and adenomas of the lung or liver	Route: Inhalation			NTP,
	ppm	mg/kg/day	mg/kg/day	
	0	0	0	5/50
	2000	15.82	122	36/48
	4000	31.64	244	46/47

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

Dose conversions used the mouse assay midpoint weight of 0.032 kg an estimated inhalation rate of 1.04 cu.m/day. To obtain estimates of unit for humans, an inhalation rate of 20 cu.m/day was assumed. Dichlorometh was considered to be a well-absorbed vapor at low doses. As of December 1987, a revision of the cancer risk assessment is pending final approval This revision contains a new inhalation potency based on the incorporati information on pharmacokinetics and metabolism.

The unit risk should not be used if the air concentration exceeds 2E ug/cu.m, since above this concentration the slope factor may differ from stated.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSU

Adequate numbers of animals were observed and tumor incidences were nificantly increased in a dose-dependent fashion. Analysis excluding an mals which died before observation of the first tumors produced similar estimates as did time-to-tumor analysis. Risk estimates for both sexes mice (NTP, 1986) were within a factor of 2, as the slope factor for male was 7.0E-3.

------<<< Dichloromethane >>>------

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESS

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Addendum to the Health Assessment Document for Dichlor methane (methylene chloride). Updated carcinogenicity assessment. Prep by the Carcinogen Assessment Group, OHLA, Washington, DC. EPA 600/8-B2/004FF.

NTP (National Toxicology Program). 1986. Toxicology and carcinogenesis studies of dichloromethane (methylene chloride) in F344/N rats and B6C3F mice (inhalation studies). NTP-TRS-306.

National Coffee Association. 1983. Twenty-four month oncogenicity stud

methylene chloride in mice. Prepared by Hazleton Laboratories America, Vienna, VA. (Unpublished)

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Health Assessment Document for Dichloromethane (methylene chloride) received Agency and external review including a rev by the Science Advisory Board.

Agency Work Group Review: 12/04/86

Verification Date: 12/04/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Lorenz R. Rhomberg / ORD -- (202)382-3895 / FTS 382-3895

Dharm V. Singh / ORD -- (202)382-5898 / FTS 382-5898

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_III. HEALTH HAZARD ASSESSMENTS FOR VARIED EXPOSURE DURATIONS

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2
Last Revised -- 03/01/88

__III.A. DRINKING WATER HEALTH ADVISORIES

The Office of Drinking Water provides Drinking Water Health Advisories (as technical guidance for the protection of public health. HAs are not enforceable Federal standards. HAs are concentrations of a substance in drinking water estimated to have negligible deleterious effects in human when ingested, for a specified period of time. Exposure to the substanc other media is considered only in the derivation of the lifetime HA. Gi the absence of chemical-specific data, the assumed fraction of total int from drinking water is 10% for inorganic contaminants and 20% for organi contaminants. The lifetime HA is calculated from the Drinking Water Equ alent Level (DWEL) which, in turn, is based on the Oral Chronic Referenc Dose. Lifetime HAs are not derived for compounds which are potentially carcinogenic for humans because of the difference in assumptions concern toxic threshold for carcinogenic and noncarcinogenic effects. A more de description of the assumptions and methods used in the derivation of HAs provided in Background Document 3 in Service Code 5.

___III.A.1. ONE-DAY HEALTH ADVISORY FOR A CHILD

One-day HA -- 1.33E+1 mg/L

LOAEL -- 1326 mg/kg/day
UF -- 1000 (allows for interspecies and intrahuman variability with the a LOAEL from an animal study)
Assumptions -- 1 L/day water consumption for a 10-kg child

Principal Study -- Kimura et al., 1971

Single oral doses of dichloromethane were administered to young adul Sprague-Dawley rats. An approximate dose of 1.3 g/kg was the lowest dos induce the first observable gross signs of toxicity.

<<< Dichloromethane >>>

___III.A.2. TEN-DAY HEALTH ADVISORY FOR A CHILD

Ten-day HA -- 1.5E+0 mg/L

NOAEL -- 15 mg/kg/day
UF -- 100 (allows for interspecies and intrahuman variability with the a NOAEL from an animal study)
Assumptions -- 1 L/day water consumption for a 10-kg child

Principal Study -- Bornmann and Loeser, 1967

Male and female Wistar rats were administered dichloromethane in dri water for 13 weeks at a dose of 15 mg/kg/day. No treatment-related effe were observed.

___III.A.3. LONGER-TERM HEALTH ADVISORY FOR A CHILD

Appropriate data for calculating a Longer-term HA is not available. recommended that a modified DWEL (adjusted for a 10-kg child) of 0.5 mg/ used as the Longer-term HA.

<<< Dichloromethane >>>

___III.A.4. LONGER-TERM HEALTH ADVISORY FOR AN ADULT

Appropriate data for calculating a Longer-term HA is not available. recommended that the DWEL of 1.75 mg/L be used as the Longer-term HA for 70-kg adult.

___III.A.5. DRINKING WATER EQUIVALENT LEVEL / LIFETIME HEALTH ADVISORY

DWEL -- 1.75E+0 mg/L

Assumptions -- 2 L/day water consumption for a 70-kg adult

RfD Verification Date = 11/06/85

Lifetime HA -- None

Dichloromethane is considered to be a probable human carcinogen. Re Section II of this file for information on the carcinogenicity of this substance.

Principal Study (DWEL) -- National Coffee Association, 1982 (This study used in the derivation of the chronic oral RfD; see Section I.A.2.)

<<< Dichloromethane >>>

___III.A.6. ORGANOLEPTIC PROPERTIES

No data available

___III.A.7. ANALYTICAL METHODS FOR DETECTION IN DRINKING WATER

Analysis of dichloromethane is by a purge-and-trap gas chromatograph procedure used for the detection of volatile organohalides in drinking w Confirmatory analysis is by mass spectrometry.

___III.A.8. WATER TREATMENT

The available information suggests that adsorption by granular activ carbon and air stripping are feasible technologies to remove dichloromet from drinking water.

<<< Dichloromethane >>>

___III.A.9. DOCUMENTATION AND REVIEW OF HAs

Kimura, E.T., D.M. Ebert and P.W. Dodge. 1971. Acute toxicity and limi of solvent residue for sixteen organic solvents. Toxicol. Appl. Pharmac 19: 699-704.

Bornmann, G., and A. Loeser. 1967. Zur Frage einer chronisch-toxischen Wirkung von Dichloromethan. Z. Lebensm.-Unters. Forsch. 136: 14-18.

National Coffee Association. 1982. 24-Month chronic toxicity and oncog study of methylene chloride in rats. Final Report. Prepared by Hazleto Laboratories America, Inc., Vienna, VA. (Unpublished)

U.S. EPA. 1985. Final Draft of the Drinking Water Criteria Document on Dichloromethane. Office of Drinking Water, Washington, DC.

EPA review of HAs in 1985.

Public review of HAs following notification of availability in October,

Scientific Advisory Panel review of HAs in January, 1986.

Preparation date of this IRIS summary -- 06/24/87

___III.A.10. EPA CONTACTS

Krishan Khanna / ODW -- (202)382-7588 / FTS 382-7588

Edward V. Ohanian / ODW -- (202)382-7571 / FTS 382-7571

------<<< Dichloromethane >>>------

__III.B. OTHER ASSESSMENTS

Content to be determined

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_IV. U.S. EPA REGULATORY ACTIONS

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2
Last Revised -- 03/01/88

EPA risk assessments may be updated as new data are published and as assessment methodologies evolve. Regulatory actions are frequently not updated at the same time. Compare the dates for the regulatory actions this section with the verification dates for the risk assessments in sec I and II, as this may explain inconsistencies. Also note that some regu actions consider factors not related to health risk, such as technical o economic feasibility. Such considerations are indicated for each action addition, not all of the regulatory actions listed in this section invol enforceable federal standards. Please direct any questions you may have concerning these regulatory actions to the U.S. EPA contact listed for t particular action. Users are strongly urged to read the background info ation on each regulatory action in Background Document 4 in Service Code

__IV.A. CLEAN AIR ACT (CAA)

No data available

------<<< Dichloromethane >>>------

__IV.B. SAFE DRINKING WATER ACT (SDWA)

No data available

------<<< Dichloromethane >>>------

__IV.C. CLEAN WATER ACT (CWA)

___IV.C.1. AMBIENT WATER QUALITY CRITERIA, Human Health

Water and Fish Consumption: 1.9E-1 ug/L

Fish Consumption Only: 1.57E+1 ug/L

Considers technological or economic feasibility? -- NO

Discussion -- Methylene chloride is classified as a carcinogen, and und assumption of no threshold for a carcinogen, the recommended WQC is zero However, if zero cannot be obtained and exposure is via ingestion of wat aquatic organisms, 0.19 ug/L is associated with an upper-bound excess li risk of 1.0E-6 [other risk levels to consider: 1.0E-5 (1.9 ug/L) and 1. (0.019 ug/L)]. If exposure is only via ingestion of aquatic organisms, WQC associated with an upper-bound excess lifetime risk of 1.0E-6 is 15. The criteria are based on halomethanes as a class.

Reference -- 45 FR 79318 (11/13/80)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

<<< Dichloromethane >>>

___IV.C.2. AMBIENT WATER QUALITY CRITERIA, Aquatic Organisms

Freshwater:

Acute LEC -- 1.1E+4 ug/L
Chronic -- None

Marine:

Acute LEC -- 1.2E+4 ug/L
Chronic LEC -- 6.4E+3 ug/L

Considers technological or economic feasibility? -- NO

Discussion -- The values that are indicated as "LEC" are not criteria, are the lowest effect levels found in the literature. LECs are given wh minimum data required to derive water quality criteria are not available

Reference -- 45 FR 79318 (11/13/80)

EPA Contact -- Criteria and Standards Division, OWRS
(202)475-7315 / FTS 475-7315

------<<< Dichloromethane >>>------

__IV.D. FEDERAL INSECTICIDE AND RODENTICIDE ACT (FIFRA)

No data available

------<<< Dichloromethane >>>------

__IV.E. TOXIC SUBSTANCES CONTROL ACT (TSCA)

___IV.E.1. TSCA, SECTION 6

Status -- Advance Notice of Proposed Rulemaking (ANPR) (1985)

Discussion -- Initiated priority review under TSCA, sect. 6, of risks fr cancer which may be associated with certain exposures to methylene chlor Receipt of a positive NTP bioassay triggered an accelerated analysis und TSCA, sect. 4(f). Based on its preliminary analysis, the Agency decided methylene chloride should be classified as a B2 probable human carcinoge under its Interim Cancer Guidelines. TSCA, sect. 4(f), requires that th Agency initiate appropriate action under sect. 5, 6, or 7 within a 180-d period of receipt of health effect information which triggers a sect. 4(decision. The sect. 6 ANPR initiated appropriate action.

Reference: 50 FR 42005 (10/17/85)

EPA Contact -- Chemical Control Division, OTS / (202)382-3749 / FTS 382-

------<<< Dichloromethane >>>------

__IV.F. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

___IV.F.1. RCRA APPENDIX IX, for Ground Water Monitoring

Status -- Listed

Reference -- 52 FR 25942 (07/09/87)

EPA Contact -- Jerry Garman / OSW / (202)382-4658 / FTS 382-4658

------<<< Dichloromethane >>>------

__IV.G. SUPERFUND (CERCLA)

___IV.G.1. REPORTABLE QUANTITY (RQ) for Release into the Environment

Value (status) -- 1000 pounds (Final, 1985)

Considers technological or economic feasibility? -- NO

Discussion -- The final adjusted RQ of 1000 pounds is based upon a chro toxicity score of 10. This substance has recently been identified for assessment of carcinogenicity, and the RQ will be reevaluated when that assessment is completed.

Reference -- 50 FR 13456 (04/04/85)

EPA Contact -- RCRA/Superfund Hotline
(800)424-9346 / (202)382-3000 / FTS 382-3000

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_V. SUPPLEMENTARY DATA

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2

Not available at this time

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_VI. REFERENCES

Substance Name -- Dichloromethane
Primary Synonym -- Methylene Chloride
CASRN -- 75-09-2

Not available at this time

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Synonyms: Methane, dichloro- (8CI9CI); Aerothene MM; Chlorure de methyle (French); Dichlormethan, uvasol; Dichloromethane; DCM; Freon 30; Methane dichloride; Methylene bichloride; Methylene chloride (ACN); Methylene dichloride; Metylenu chlorek (Polish); Narkotil; NCI-C50102; R 30; Solae Solmethine; WLN: G1G; 1,1-Dichloromethane.